



C-Tran, Vancouver, WA (opening 2016)

Bus Rapid Transit

A GUIDE FOR LOCAL JURISDICTIONS TO
EVALUATE THE FEASIBILITY OF BUS RAPID TRANSIT



Metro Orange Line, Los Angeles, CA



Max BRT, Las Vegas, NV

Introduction and Purpose

Bus Rapid Transit (BRT) is a transit option that is flexible in implementation and can be designed to fit a variety of local conditions along routes with relatively high levels of activity, density and demand for trips throughout the day. By investing in roadway, right-of-way, intersection and signal improvements, BRT service can provide improved travel speeds, reliability and quality of transit service. BRT can help local jurisdictions and transit agencies offer their customers sustainable transportation options that facilitate the safe, convenient, affordable and efficient movement of people. However, BRT is not always the “best” solution. Implementing or expanding commuter bus service, express bus, new local bus routes and improvements to existing bus service could be more appropriate options for local jurisdictions and transit agencies to explore when deciding how best to meet their transportation needs.

The Maryland Department of Transportation (MDOT) produced this guide to provide local jurisdictions, transit agencies and other stakeholders an outline of how to make careful and informed decisions about BRT. This guide also is intended as a resource to help local jurisdictions and transit agencies better understand how to assess BRT as a locally-owned and operated facility and how to best work with the State.

As local agencies assess the viability of BRT, they should include and collaborate with MDOT’s Maryland Transit Administration (MTA) and State Highway Administration (SHA). At MDOT’s discretion, these business units can provide technical advice and assistance with coordination and evaluation, best practices and possible financing strategies.



MDOT encourages local jurisdictions and transit agencies to carefully consider whether BRT can be an effective solution to their transportation needs. This guide was written to help local governments understand the factors involved when evaluating the feasibility of BRT, especially if it is expected that State or federal funding or other resources will be needed to successfully implement the service. This guide will provide information on:

- land use and transit service characteristics supportive of BRT;
- BRT’s flexibility and the influence different BRT elements have on system performance;
- opportunities for phasing BRT elements into service;
- roles and responsibilities of project partners; and
- methods for examining BRT feasibility at the corridor and project level.

BRT projects have been successfully implemented in many cities in the United States (US) as diverse as Eugene, Oregon; Cleveland, Ohio; Aspen, Colorado; Boston, Massachusetts; and several large and small cities in Southern California. BRT as a transit mode has been supported by the Federal Transit Administration (FTA) since 1998. The information contained in the following pages reflects best practices in research and implementation nationwide.





EmX, Eugene, OR



Metro Orange Line, Los Angeles, CA



Metro Transit, Minneapolis, MN

Where Is BRT Appropriate?

One of the major strengths of BRT as a transit mode, as shown increasingly throughout the US and the world, is its high degree of flexibility. BRT can address a broad range of mobility and development challenges in a variety of conditions. Accordingly, BRT should be thought of as a menu of options to select from, tailored to the conditions and challenges in a given corridor. However, there are some general land use and transit service characteristics that are favorable to the implementation of BRT.

Land Use Characteristics

BRT is appropriate for multi-nodal corridors that:

- generate intermediate trips throughout the day and
- have a transit-supportive development pattern including:
 - » concentrations of density and/or mixed-use development and
 - » a walkable environment.

Comparatively, corridors that support longer end-to-end trips or trips only in peak periods may be better suited for express or commuter bus.



Metro Rapid, Los Angeles, CA

BRT Service Characteristics

The FTA currently defines BRT as a bus system that meets the following criteria:

- ideally, at least some of the route operating in a right-of-way dedicated for transit use during peak periods;
- defined stations that are accessible for persons with disabilities, offer shelter from the weather and provide information on schedules and routes;
- intersection signal priority through congested intersections and/or queue jump lanes in areas without a dedicated guideway;
- at least a 14-hour span of service on weekdays and a 10-hour span of service on weekends with a minimum of 10-minute headways in the peak and 15-minute headways in the off-peak period on weekdays and 30-minute headways on weekends; and
- a separate and consistent brand to easily identify stations and vehicles.

BRT Elements and Performance

BRT uses a variety of elements to improve travel speed, reliability and quality of transit services by investing in roadway, right-of-way, intersection and traffic signal improvements to speed up service. The primary challenge for BRT project sponsors is selecting an appropriate set of design and operational elements that fulfill the project's objectives and whose costs can be reasonably justified when considering the planned service level and expected ridership.

Although individual BRT projects can select different infrastructure and service elements, the desired outcome is the same—improved customer satisfaction, while increasing the number of people that can be carried within the corridor.

Improved customer satisfaction can be accomplished by:

- reducing travel times for transit users;
- improving trip reliability;
- enhancing system recognition and wayfinding through system branding, image and identity;
- improving safety and security;
- using vehicles that maximize capacity while maintaining customer comfort; and
- improving transit connections and providing more direct service.

BRT system performance and the service's provision of improved customer satisfaction are based on the selected combination of BRT elements. Each BRT element influences different aspects of the system's performance. The combination of elements enhances the BRT system's ability to attract more riders.

Influence of BRT Elements on Transit System Performance			
BRT Elements	Travel Time Savings	Reliability	Capacity
Running Way			
Running Way Location	✓	✓	✓
Level of Transit Priority	✓	✓	
Running Way Guidance	✓	✓	
Stations			
Station Location & Type	✓		✓
Platform Layout	✓	✓	✓
Passing Capacity	✓	✓	
Vehicles			
Vehicle Configuration	✓		✓
Passenger Circulation Enhancement		✓	✓
Fare Collection			
Fare Collection Process	✓	✓	
Fare Media/Payment Options	✓		
Intelligent Transportation Systems			
Vehicle Prioritization	✓	✓	
Intelligent Vehicle Systems	✓	✓	
Passenger Information Systems		✓	
Service Plans			
Span of Service		✓	
Frequency of Service		✓	
Station Spacing	✓	✓	

A Variety of BRT Options

Depending on the combination of system elements selected, the BRT service will fall along a spectrum of system configurations. At one end of the spectrum is BRT “lite,” which uses combinations of system elements whose cost is in the lower end of the spectrum. At a minimum, BRT “lite” typically includes the following elements:

- transit signal priority at some intersections;
- real-time information provided to passengers on vehicle status;
- distinctive vehicles with low floor boarding; and
- branding specific to the BRT system.

These combined attributes have proven to offer measurable travel time savings when compared to local bus service along the same route.

At the other end of the spectrum is full BRT, which incorporates most or all of the system elements. In addition to elements that typically comprise BRT “lite” systems, full BRT systems typically:

- have exclusive BRT running ways for a majority of its route length;
- have enhanced stations with various amenities such as seating, passenger information displays, off-board fare ticket machines and newspaper kiosks; and
- operate with high-capacity BRT vehicles (for example, 60-foot articulated buses with increased capacity and BRT-branded design).

¹ The characteristics of full BRT in the United States may differ from those of international BRT systems. Refer to *Bus Rapid Transit Planning Guide (2007)* for international examples of full BRT, as described by the Institute for Transportation & Development Policy.

² Caltrans, *Bus Rapid Transit: A Handbook for Partners (2007)*

Between BRT “lite” and full BRT is a full set of element attributes that are applied depending on the characteristics of the corridor and priorities of the implementing agency. This range of applications could be considered hybrid BRT, which typically has a higher level of attributes, including vehicles operating in dedicated running ways for a portion of the route or advanced fare collection systems. It is important to note that hybrid BRT also could consist of a combination of solutions that best fit within the communities along a longer corridor, with full BRT in some segments and BRT “lite” in other segments.

It may not be possible to implement full BRT at the onset even if that is the final desired outcome. However, to improve transit service reliability and add capacity along a corridor, a transit agency could program some BRT elements in the short term while planning a more comprehensive BRT service as a longer term goal. There are systems nationally (Los Angeles and others) that have successfully followed this implementation method.

	BRT “Lite”	Full BRT ¹
Running Ways ²	<ul style="list-style-type: none"> • Shared lanes in mixed traffic • Some preferential treatments, e.g., “queue jumps” at intersections 	<ul style="list-style-type: none"> • Dedicated running ways, exclusive bus lanes • Distinctive pavement treatment • HOV drop ramps
Stations ²	<ul style="list-style-type: none"> • Improved shelter • Special signage • Transfer centers 	<ul style="list-style-type: none"> • Level boarding and alighting • “Branded” and consistent with appearance of BRT vehicles • High-quality, attractive, functional amenities
Vehicles ²	<ul style="list-style-type: none"> • Exterior and interior aesthetics • Enhanced ride and comfort • Low-floor, low-emissions • Sleek styling 	<ul style="list-style-type: none"> • Easy-to-board (level with platform) • Multiple-door boarding and alighting • “Branded” exteriors that are distinctive and consistent with appearance of stations • High capacity • Pleasant interior conveniences • Low or zero emissions
Fare Collection ²	<ul style="list-style-type: none"> • Increase prepaid fare sales 	<ul style="list-style-type: none"> • Off-vehicle fare collection • Emphasis on prepaid fares
ITS ²	<ul style="list-style-type: none"> • Automated vehicle location (AVL) • Bus priority at traffic signals • Real-time passenger information at stations 	<ul style="list-style-type: none"> • Real-time “next bus” arrival information signs at stations • “Next stop” signs on board buses • Smart fare payment media and technology • Traffic signal prioritization • Traffic management and automated guidance features for precision operations and docking
Service Plans ²	<ul style="list-style-type: none"> • Improved frequency • Integrated regional coordination • Extended station/stop spacing • Simple route structures 	<ul style="list-style-type: none"> • Frequent all-day service • Short headways (10 minutes or better) • Wide station stop spacing • Simple route layout • Convenient transfers • Station locations coordinated with land-use plans • Service to major activity centers

Evaluating BRT Feasibility

MDOT encourages local project sponsors to carefully and critically assess whether BRT is an appropriate solution for their transportation needs. The two-step process described below is recommended to screen the feasibility of a potential BRT project in order to determine whether it should be advanced for more detailed study. The first step screens the potential of a corridor to support BRT, and the second step evaluates preliminary project criteria more specific to the intended implementation of BRT in that corridor.

Working with MTA and its BRT coordinator, the local project sponsor takes the lead in conducting the screening process. The BRT coordinator can provide clarification on the screening process, suggest possible data sources, provide information on best practices and coordinate with appropriate State agencies. MDOT will use the results of the screening process to evaluate requests for State or federal assistance (funding or other resources) for BRT projects. MDOT funding of any locally-initiated BRT project will be made alongside funding decisions for other transportation project priorities. Any BRT project that the State would participate in implementing would be a partnership with the local jurisdictions, and it is assumed the local jurisdictions would have substantial funding responsibilities.



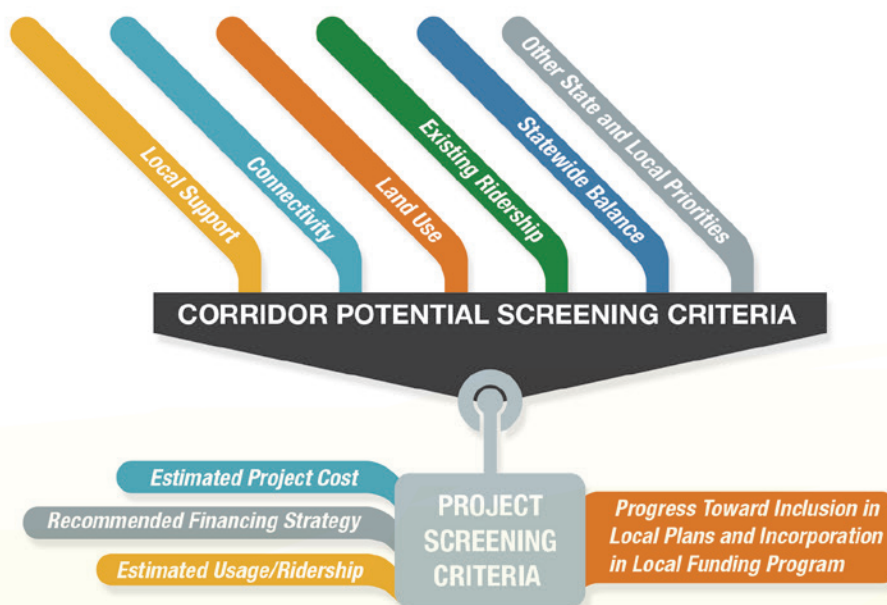
Corridor Potential Criteria

The corridor potential criteria will help MDOT and jurisdictions evaluate how appropriate the corridor is for BRT. The MTA and local project sponsor should document public support for the project, the connectivity the project will provide, whether the current and planned land use conditions are supportive of rapid transit, the corridor's ability to contribute to the Statewide transportation balance and any other issues deemed important. Once the screening information that demonstrates the corridor's potential for BRT service is assembled, MTA will lead a discussion with MDOT, SHA and the local project sponsor about the corridor's potential. If the corridor is felt to have potential, MDOT will advance the corridor to the project evaluation step.

These criteria provide an assessment of corridor feasibility based on indicators found in national literature, along with thresholds outlined by MDOT.

1. Local Support

Having local support is a key factor in project success. This support can be measured by



identifying the official documents that express support for the corridor or project. Documents can include, but are not limited to, municipality/county council resolutions, an adopted comprehensive plan and a recommendation in a previously conducted corridor study. It is expected that the project will have clear support.

2. Transportation Network Connectivity

The proposed BRT corridor should offer connections to other transit services because the interconnections enhance the overall multimodal network. Local project sponsors should identify the number of times the proposed corridor intersects with existing or near-term expansion of a rail, BRT or bus network.



3. Transit Supportive Land Use

The current or adopted future land use characteristics of the corridor should be supportive of rapid transit. The corridor should contain several nodes with an activity density (the sum of jobs and people per acre) of at least 25 and multiple activity areas capable of generating intermediate trips throughout the day. The development character of the nodes and activity areas should be transit supportive with: building entrances oriented toward the street, sidewalk or other public area; street furniture, trees and other pedestrian amenities; limited parking supply; and a mix of uses.

4. Existing Ridership

Even though past transit performance is not a definite proxy for future ridership, looking at the corridor's current ridership can help justify the need for BRT service in the corridor. Local project sponsors should calculate the number of daily weekday transit trips and annual transit trip in the corridor. If there are additional transit routes within ½ mile of the corridor, list the daily weekday and annual trips for those routes too.

5. Contribution to Statewide Transportation Balance

So as to provide a balanced transportation network and provide equity across regions and jurisdictions, the local project sponsors should consider the proposed corridor in the context of past, present and reasonably-foreseen transportation activities and investments being made in the area.

6. Contribution to Other State and Local Priorities

MTA and the local project sponsor should document how BRT in the corridor would address State and local concerns such as congestion reduction, transit dependence, climate change, priority development/funding areas, economic development potential and State Smart Growth policies.

Project Criteria

The project screening criteria evaluate the project's financial feasibility and consider how the project will advance from planning through implementation.

Local project sponsors working with the BRT coordinator should:

- prepare a project description that details the BRT characteristics envisioned for the service;
- develop an estimated total project cost, including capital, operating and maintenance;
- propose a financing strategy that includes a high-level implementation timeline;
- estimate usage/ridership; and
- demonstrate progress toward including the project in the county comprehensive plan, budget/capital program and/or regional long range transportation plan.

Project Description

The project should be described in sufficient detail in order to develop an estimated total project cost. At a minimum, the description should include the route length; the length and type of dedicated right-of-way; the length of mixed traffic running ways, intersection improvements and transit priority treatments; the number and type of stations, passenger amenities including technology improvements such as real-time information and required complete streets and environmental elements.

If the BRT project is proposed to be located on a State highway facility, the MTA and local project sponsor should involve SHA early in the evaluation process. SHA's Complete Streets Policy "requires that all SHA staff and partners consider and incorporate complete streets criteria for all modes and types of transportation when developing or redeveloping our transportation system." If the proposed BRT project requires modification to a State highway, SHA's design guidelines must be followed and inclusion of new complete street elements must be evaluated and included where deemed feasible. If the proposed BRT route is located on the National Highway System, the project must address federal performance-based planning requirements.

Estimated Total Project Cost

The estimated total project cost is based on the project description and uses per unit costs provided by the BRT coordinator. The estimate not only includes the physical components needed to operate the system, but any complete street and stormwater management improvements that are required if the roadway right-of-way is modified or there is an increase in paved surfaces. If the ridership estimate relies on a new feeder bus system, the estimated project cost (capital, operating and maintenance) should include the cost of the proposed supporting feeder system. The estimated total cost should include the capital, operating and maintenance costs of the project. The local jurisdiction or transit agency will be responsible for all operating and maintenance costs of the project, in addition to their share (at least 40 percent) of the capital costs. MDOT may consider a State match to the operating and maintenance costs (up to 25 percent) based on the merits of the project based on the criteria outlined in this guidance.

Proposed Financing Strategy

After an estimated project cost is developed, the local project sponsor, with input from MTA, should develop a preliminary strategy for financing the project. The proposed financing strategy should outline expected sources and timing for funding and demonstrate a significant local

financial commitment to the project. The strategy also should include an estimate of the State, federal and private sector financial commitment, if those sources are proposed. Please note that based on the merit of the BRT project, the State and federal share could be as much as 60 percent of the capital costs; however, 40 percent or more of the capital costs would need to be covered by local and private partners.

Estimated Usage/Ridership

Using industry estimating methods, the FTA's STOPS model or an approved forecasting model, the local project sponsor develops a ridership estimate for the proposed BRT service. The operating assumptions should be the same as those used to develop the estimated project cost and proposed financing strategy. MTA has invested in the development of a number of tools and has coordinated on multiple projects determining transit ridership and should be consulted in this process and be considered a technical resource.

Local Commitment

The local project sponsor should demonstrate that local plans and policies are supportive of the project. Documentation could include the adopted comprehensive plan, the long range transportation plan, the capital improvement plan, the budget, etc.

Roles and Responsibilities of Potential Partners

While the local project sponsor has the primary responsibility to demonstrate the feasibility of a proposed BRT project, the successful planning, implementation and operation of BRT service relies on many partners. Some are engaged throughout the entire life of the service while others' involvement depends on the project's phase. Early and ongoing engagement with project partners about the need for the project, progress and expected outcomes is an important component of creating an implementable project.

Public

Since the intent of the BRT service is to provide improved transportation mobility to the public, the local project sponsor must work with community groups and other interested stakeholders to develop a project that provides the service they would find beneficial. Successful engagement informs and educates the public, offers the public opportunities to share their concerns and desires, provides opportunities to resolve conflicts and ultimately gains the public's support for the project.

Municipal/County Government

Transportation, Public Works and Planning Agencies

Municipal/County transportation, public works and planning agencies are responsible for developing land use and transportation plans and strategies to accommodate population and employment growth and the efficient movement of people and goods. Providing new transportation options, including BRT service, would be a recommendation of the agencies that would be implemented by the local transit agency. These agencies, along with the transit agency, are often responsible for assessing BRT's feasibility and responding to any local-driven requirements.

Local Transit Agency

The local transit agency is responsible for the planning, implementation and operation of the BRT service, as well as associated systems and continued maintenance and safety activities. The transit agency is the face of the BRT/transit service and is responsible for providing good

service and marketing the system. In a growing number of cases nationally, the transit agency is contracting BRT services, which can include operations, maintenance and marketing responsibilities, to private providers. In all cases, however, ultimate responsibility for these roles remains with the public-sector transit agency.

Metropolitan Planning Organizations

If the project is located in an urban area, and depending on the MPO's work program, the MPO may be able to provide local project sponsors with information needed to assess BRT feasibility, technical assistance to prepare an evaluation of BRT feasibility or funds for conducting a BRT planning study. For a BRT project to receive federal funding, it needs to be listed on the MPO's Transportation Improvement Program (TIP). If the project is not located in an urban area, then it needs to be listed in the State's Transportation Improvement Program (STIP).

Maryland Department of Transportation

MDOT and two of its business units, the Maryland Transit Administration and the State Highway Administration, are advisors who can help local project sponsors with agency coordination, information on BRT best practices

and possible financing strategies, and perspective on a project's context and how it could interact with and influence other State and local activities.

The MTA is the lead MDOT business unit for BRT. The MTA educates local governments and transit agencies about BRT development and implementation, assists with ridership estimating, coordinates the evaluation process and manages project development if a proposed BRT project seeks State and/or federal funds.

It is SHA's role to work with the partners to ensure the BRT project is in compliance with State guidelines and policies for design and highway system performance. If a locally-initiated BRT project is anticipated to travel on a State road, it is important to engage SHA early in the planning process. Once corridor feasibility has been demonstrated, SHA should, as long as funding and project evaluation resources are available, conduct a corridor study and coordinate with local agencies, transit agencies and MTA to evaluate the impact of a BRT program to existing and future roadway users and develop possible mitigation approaches.

Implementing BRT: When, What, and Who

● Lead Partner ● Coordinating Partner ○ Supporting Partner

	Public	Municipal/County Government - Transportation, Public Works, Planning Agencies	Local Transit Agency	Metropolitan Planning Organizations	Maryland Department of Transportation	Federal Transit Administration	Elected Officials/Political Champions	Private Business Sector
Concept Development • Identify issues to be addressed • Evaluate current conditions and future needs/opportunities	○	●	●	●	○		○	○
Preliminary Screening • Determine preliminary corridor feasibility • Determine preliminary project feasibility	○	●	○	○	●		○	
Funding • Develop preliminary financing strategy • Estimate local, State, federal and private sector commitments • Initiate right-of-way preservation		●	●	○	○	○		○
Planning • Complete environmental review processes • Develop and review alternatives • Select preferred alternative • Determine Operator • Adopt in fiscally constrained long range transportation plan	○	●	●	●	●	●	○	○
Design • Identify sources and gain commitments for funding • Complete engineering and design	○	●	●		●	●	○	○
Construction • Secure required rights of way • Install required equipment • Build necessary infrastructure	○	○	●		●	○		
Operations • Promote and initiate service • Monitor service performance	○		●		●	○		

Federal Transit Administration

Two of the most popular federal funding sources BRT projects can compete for are FTA's New Starts/Small Starts program and discretionary grant programs such as USDOT's TIGER grant process, with FTA evaluation assistance for transit-related TIGER grants.

Elected Officials/Political Champions

Elected officials advance projects by approving them as part of their jurisdictions' budgets and putting them in their State funding priority letters to MDOT if seeking State and/or federal funding or by advocating for their implementation. They also can serve as project champions, generating support among their constituents and other stakeholders.

Private Business Sector

Improved access and mobility for customers, employees and residents can make business and land owners BRT project supporters. Their support can take many forms ranging from advocating for project funding at the local, State and federal level to providing capital financial support or participating in the funding and maintenance of station facilities.

Along a BRT corridor, there are typically four kinds of business and land owners who are able to influence and impact BRT:

- business owners who anticipate that BRT service will provide their customers and employees with improved mobility and will increase the business's market area and attract new customers;
- business owners who worry the service will make it harder for customers to arrive if design decisions impact parking or traffic along the corridor;
- property owners who see the arrival of improved transit service as a contributor to the attractiveness and demand for residential or commercial development along the corridor and who would be willing to help fund a portion of the construction or operation/maintenance of the system through various means; and
- property owners who would not fund the service, but whose development decisions for land adjacent to the corridor would significantly affect ridership.

As the demand for local, federal and State transportation funding becomes more pronounced, innovative funding sources for designing, constructing and operating the

proposed service can gain importance and help address identified funding shortfalls. For example, this can include new or non-traditional sources of revenue such as new institutional arrangements between public and private entities including the use of private financing through public-private partnerships. A BRT program could take advantage of these sources as a way to deliver the service more quickly than it could if relying only on traditional funding sources.

Next Steps

MDOT's decision to participate in a locally-initiated BRT project will be made alongside decisions for other transportation project priorities as part of the normal Consolidated Transportation Program (CTP) process. The type and scale of State participation will depend on several factors including the magnitude, viability and merit of the proposed project, whether the project travels along State highways and whether federal funds will be sought.

Since the State's resources are limited, it is not possible to participate in every worthwhile and useful project. Regardless of the outcome of the State's decision about a locally-initiated BRT project in a given year, if the local project sponsor believes in the project, it should continue to advocate for it. Advocating for a project includes:

- conducting studies to refine project details;
- revising land-use plans and zoning ordinances to increase development intensity along the corridor;
- encouraging local project champions to promote the project;
- identifying first steps and early action items that can bring BRT elements – in any form – to the corridor;
- identifying and securing local or other funds to implement part or all of the project; and
- implementing sections or parts of the BRT system it can afford in a logical manner.

BRT can be the best transit resource for the right corridors. Other transit corridors may be best served by other transit options including: commuter, express or improved local services. The outcome of any process considering improvements to transit should be focused on finding the solutions that fits best for the individual jurisdiction; MDOT is committed to working with communities to find the right solutions.

Further Reading

TCRP Report 118: Bus Rapid Transit Practitioner's Guide

Transportation Research Board, Washington, D.C., 2007

http://www.tcrponline.org/PDFDocuments/TCRP_RPT_118.pdf

TCRP Report 90: Bus Rapid Transit, Volume 2: Implementation Guidelines

Transportation Research Board, Washington, D.C., 2003

http://www.tcrponline.org/PDFDocuments/TCRP_RPT_90v2.pdf

Characteristics of Bus Rapid Transit for Decision-Making (CBRT)

National Bus Rapid Transit Institute, Center for Urban Transportation Research,
University of South Florida, Tampa, FL, 2009

<http://www.nbrti.org/CBRT.html>



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